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CO	Confidential, only for members of the consortium (including the Commission Services)	

This report deals with the development of novel Total Site optimisation models of energy, cost and environmental impact, and practical implementations and usability of those models.

Several novel algorithms have been developed for single-objective Total Site optimisation of energy and cost, and multi-objective Total Site optimisation accounting besides energy and cost also environmental impact. The models are suited for both grassroots (new designs) as well as for retrofits (existing designs). Particular emphasis was given to proper accounting of uncertainty by multi-period optimisation approach and Monte Carlo synthesis. Mathematical programming approach has been employed where the tendency was to obtain globally optimal and sustainable solutions.

Besides, novel algorithms developed also the novel concept of environmental impact assessment has been developed, and it is based on total impacts consisting of both, burdening and unburdening effects. The overview of methods and tools for measuring environmental sustainability has been performed, and the recent development in environmental footprints evaluation has been studied. All those methods are based on Life cycle assessment, which is the key methodology for environmental impact evaluation and multi-objective optimisation optimising environmental performance besides other criteria. It considers the entire supply chain or supply network and lifetime of the system by preventing burden shifting between phases. The integrated frameworks have been developed for several environmental metrics and several environmental impact indices. Environmental impact criteria have been embedded into developed overall process synthesis and optimisation strategies.

Furthermore, the novel method was developed for handling the problems with large number of criteria in multi-criteria multi-objective optimisation solutions, called Representative Objectives Method and it was applied to both – direct environmental metrics only (burdening effects), and also total environmental metrics (burdening and unburdening effects).

All the algorithms and methods are coded as mathematical programming formulations and are written in generic data-independent way so that they could be applied to any other case study or any industry by changing the data. Those developed novel algorithms, concepts and strategies have been applied to case studies and will be illustrated in the report.

The novel developed systematic models for Total Site optimisation will be tested and evaluated on industrial Total Site during demonstration work package, and will also be illustrated in Deliverable 8.3.